JPRS-JST-86-004

12 February 1986

Japan Report

SCIENCE AND TECHNOLOGY

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-JST-86-004

12 February 1986

JAPAN REPORT

SCIENCE AND TECHNOLOGY

CONTENTS

DEFENSE INDUSTRY

Fiscal 1986 Defense Programs Outlined
(BOEI ANTENA, Jun 85).................................... 1

Weapons and High-Technology Discussed
(GUNJI KENKYU, May 85).................................... 4

Defense Industry's Requests Related to 59 Chugyo
(Gakuji Moriya; KEIDANREN GEPPO, May 85).................. 11

NUCLEAR DEVELOPMENT

Annual Report on Nuclear Power for 1984
(SHIGEN TO ENERUGI, Mar 85)............................... 16

DEFENSE INDUSTRY

FISCAL 1986 DEFENSE PROGRAMS OUTLINED

Tokyo BOEI ANTENA in Japanese Jun 85 pp 10-11

[Article: "Indications of the Director General of the Defense Agency, Concerning Which Items Should Be Guidelines, When the Plan for Fiscal 1986 Is Prepared"]

[Text] The plan for fiscal 1986 will be prepared with a view to promoting the defense buildup with a good balance between front-line equipment and logistic support, while enhancing the qualitative aspect of the defense buildup to make it possible to cope with trends in defense technologies of various foreign countries in consideration of Japanese geographical characteristics, etc. When the plan is prepared, special attention will be paid to the following items, also referring to the mid-term defense plan estimate for fiscal 1984, presently being prepared.

Also, in deciding what programs to be appropriated, defense capability shall be efficiently maintained, carefully studying the needs and priority of these programs in consideration of the presently stringent fiscal condition and recommendations of the Ad Hoc Commission on Administrative Reform.

1. Ground armaments will be completed, attaching importance to the rise in antitank firepower, artillery firepower, air-mobile power, etc.

2. Armaments such as ships, antisubmarine aircraft, etc., will be completed, attaching importance to the rise in air defense, antisubmarine, antimine warfare capabilities, etc.

3. Maintenance of interceptor fighters, surface-to-air guided missiles, new air-defense ground environments, etc., will be completed for the purpose of enhancing the air defense capability.

4. Command and communication and information collecting functions will be completed, and electronic warfare capability will be enhanced.

5. Efforts will be made to enhance invulnerability of bases, etc., combat readiness, and war sustainability by sufficiently storing operational materials such as ammunition, torpedoes, missiles, etc. Further efforts will be made to ensure various supporting postures and to enhance transportation capability.

6. The necessary and minimum personnel for maintaining and utilizing the defense capability will be obtained, taking care to efficiently assign the personnel.

7. Systems necessary for joint operations will be established; i.e., various research on defense activities will be conducted, various exercises including Japan-U.S. combined training will be carried out, and the Central Command System will be operated smoothly.

8. Efforts will be made to ensure the capability necessary for carrying out thorough education and training of soldiers and maintaining and enhancing skill levels in their respective specialities.

9. Efforts will be made to complete life-related facilities such as barracks, billets, etc., and to complete facilities necessary for maintaining the function of bases, etc.

10. Recruitment and supporting services will be completed, and the study on personnel affairs, such as the annuity problem, etc., of SDF personnel will be carried out. Also, the SDF reserve personnel system will be completed.

11. Measures will be taken for the purpose of preventing aircraft accidents.

In fiscal 1986, efficient research and development will be carried out in consideration of the presently stringent fiscal condition and recommendations of the Ad Hoc Commission on Administrative Reform, and on the basis of the policy in which systems for technical research and development will be completed for the purpose of maintaining and enhancing the qualitative level of the defense capability. When the efficient research and development is carried out, the plan shall be prepared, taking notice of the following points.

1. Technical Development

(1) Strictly selected items will be developed technically while referring to the mid-term defense program estimate for fiscal 1984, presently being prepared. Surface-to-ship guided missiles, new tanks, new antisubmarine helicopter (ship-based type) systems, intermediate-class training aircraft, etc., whose development has already been started, will be developed continuously.

(2) The tests and evaluations of surface-to-ship guided missiles, intermediate-class training aircraft, etc., will be carried out accurately and efficiently.

2. Technical Research

(1) Efforts will be made to enhance the technical capability in items such as aircraft, guided weapons, electronic equipment, etc., which are considered to be particularly important from the defense standpoint.

(2) Technical policies related to research on infrared devices, new materials, millimetric waves, etc., and enhancement of command and communication

and information collecting functions, will be studied on the basis of results and trends of recent, rapid technical innovations to positively use high-technology in equipment and materials.

3. Others

(1) The research and development of technology, such as operational software, operation of equipment systems, etc., will be carried out.

(2) Technical research and development of present equipment, materials, etc., will be carried out by modifying them to modernize them.

(3) Efforts will be made to ensure the community among Self-Defense Forces and commonality between Japan and the United States, and to lower the cost and maintenance expenses of weapons, equipment, materials, etc.

(4) Mutual exchange of technologies in the defense field between Japan and the United States will be promoted, necessary postures for its maintenance will be studied, and activities for exchanging technical data and information based on the Data Exchange Agreement will be further promoted.

(5) Research and evaluation systems will be further completed for the purpose of coping with trends of high-performance equipment, materials, etc.

20143/6091
CSO: 4306/3542

DEFENSE INDUSTRY

WEAPONS AND HIGH-TECHNOLOGY DISCUSSED

Tokyo GUNJI KENKYU in Japanese May 85 pp 197-204

["Part III: Materials for Electronic Parts" by Takeshi Hondoh, G Group Leader of Defense Industry of R and D Planning Co., Ltd.]

[Excerpts] Materials for Electronic Parts for Military Use

Japan has made rapid progress in state-of-the-art technology, such as electronic technology, etc., during the 40 years since World War II. Japanese semiconductors, optical fiber, CCD (charge coupled device), etc., have reached world levels. Described hereunder are materials for electronic parts, used for defense equipment.

IC (Integrated Circuit)

The semiconductor IC (integrated circuit), which first made its appearance in 1958, brought about revolutionary development in electronics. Electronic circuits, which had been made of vacuum tubes up to that time, were converted into new type electronic circuits on a large scale. Subsequently, over the last 20 years, very high-speed devices have been enthusiastically developed in order to instantly process large amounts of information and to highly integrate circuits extending over VLSI's (very large-scale integrated circuits).

At present, VLSI's are being manufactured on the basis of MOS (metal oxide semiconductor) technology, which employs silicon as the material for substrate (foundation for assembling transistor circuits) with a view to highly integrating circuits. However, the demand for precise substrate materials possessing excellent insulation and heat radiation properties has become proportional to the progress of high integration of IC's; i.e., how many devices can be put on chips of a several millimeter-square shape? Accordingly, ceramics, etc., have been used as substrate materials.

Conditions required for substrate materials are the following: 1) high electric insulation resistance; 2) high thermal conductivity; 3) high mechanical strength; 4) small amount of radiation discharged; 5) formation of smoothing surface; 6) chemical inertness; 7) neither deformation nor change of properties; and 8) low cost.

In particular, above items 1) and 2) are indispensable for substrate materials. This is because the treatment of heat emitted from semiconductor devices is a large problem accompanying the progress of high density IC assembly, and is an obstacle to the high integration of IC's. Therefore, measures to efficiently conduct heat must be taken by selecting high-temperature conducting materials.

Of the ceramic materials used, the optimum material at present is alumina. In addition to alumina, beryllia was considerably promising, because the heat conductivity of beryllia is 10 times that of alumina. But beryllia cannot be used except for special cases because it is toxic. The HITACERAM SC-101 was developed by adding beryllium oxide to silicon carbide. As a result, its electrical insulating properties were enhanced, and this material has attracted attention as a substrate material to replace silicon.

On the other hand, gallium arsenide (GaAs) is being developed as a very high-speed device material which will surpass silicon. Very high-speed processes depend on the moving speed of electrons in the substrate. The moving speed of gallium arsenide IC's is five times that of silicon IC's. In addition, greater expectation can be placed on gallium arsenide IC's than on silicon IC's, with respect to very high-speed and operation at low power consumption, because half-insulating substrates can be used for gallium arsenide IC's.

Josephson devices are superconductive IC's which employ the Josephson effect at cryogenic temperatures, and possess performance which is exceedingly higher than semiconductor IC's. At present, research on Josephson devices is being carried out by using a freezer that produces temperatures of -268°C, so that these devices can be used in large computer systems. However, the research has gone away from utilization, because IBM preceding in such research has reduced the scale of the development project.

In addition to Josephson devices, a device called "HEMT" (high electron mobility transistor) is being developed by Fujitsu, Ltd., and has attracted both foreign and Japanese attention. This is a transistor in which two-dimensional elements are controlled by gate electrodes in consideration of the high mobility of these elements having a lattice structure consisting of crystals formed by mixing gallium arsenide and aluminum arsenide. It is said that the HEMT possesses very high-speed properties at cryogenic temperatures and that HEMT IC's are superior to gallium arsenide IC's even at normal temperatures.

Also, hybrid IC's are being developed to contain a large number of highly integrated elements such as CPU (central processing unit), memory, gate array, etc. It would be better to call them "highly systematized electronic equipment" rather than to merely call them "parts."

For example, the demand for hybrid IC's for missile systems has increased exceedingly because it is necessary to microminiaturize and lighten all circuits, such as analog circuits (A/D conversion, i.e., analog-to-digital conversion and D/A conversion, i.e., digital-to-analog conversion), gyroscopic circuits, and high exothermic analog drive circuits, including power

transistors which control flight wings, as well as CPU, memory, and peripheral control logic circuits.

For this reason, materials with high thermal conductivity are being developed so they can be used as multilayer inter-connection substrate materials. Ceramic materials, such as the foregoing silicon carbide and aluminum nitride have also attracted attention.

Also, gallium arsenide and CMOS (complementary metal oxide semiconductor)/SOS (silicon on sapphire) will probably be required in the future because radiation resistance is required for defense equipment.

In addition, microwave IC's have been developed to lighten and miniaturize defense armaments and enhance their reliability. This development will be carried out continuously. Initially, development was being carried out to convert conventional microwave circuit parts into microwave IC's. Now, methods of enhancing structural density are being devised, because if individually miniaturized and lightened microwave IC's are connected with connectors or cables, it would be meaningless to miniaturize them.

It is greatly expected that this would not only be more proper but also more economical to adopt the above-mentioned methods, in particular, to aircraft, satellite loading equipment, etc., whose volume, mass, etc., are limited, and in many of the same kinds of equipment, such as electronic scanning antenna, satellite communication equipment, and broadcasting receiver. Alumina is most frequently used as the substrate material for microwave IC's, and beryllia is used for large electric power.

The Defense Department of the United States started a project called "VHSIC (very high-speed integrated circuit)" in 1980 and plans to finish it in 1988. Its main purpose is to process high-speed real-time signals. It is anticipated that the project will have an exceedingly great impact on weapon systems in the 1990's.

Silicon VLSI's having speeds of more than 100 times that of present VLSI's are being developed. High-speed silicon VLSI's will bring about revolutionary changes over all matters concerning defense electronics, such as radar equipment, electronic warfare, picture images, signal processing, computers, etc., and will strengthen defense electronic systems.

This plan is divided into three phases. In the first phase, the development of 1.25-micron technology and development of chips and new systems by using this technology will be carried out by six companies: Hughes Aircraft Corporation, Honeywell, Texas Instruments, TRW Corporation, Westinghouse, and IBM. In the second phase, the development of 0.25-micron technology will be carried out by three companies: Honeywell, TRW, and IBM, to obtain silicon VLSI's having a speed of more than 100 times that of present VLSI's. In the third phase, the development of technology for supporting these VLSI's will be carried out.

Optical Fiber

Extremely high optical fiber transmitting technology is required for defense equipment. An optical fiber command guidance can be cited as an example in which optical fibers are used as signal transmitting systems for guiding missiles. Optical fibers can be used for transmitting not only guidance signals, but also wideband signals such as image signals to missiles, because these fibers can be used for bi-directional wideband transmission. In addition, they can be used as down-links which transmit information from a missile to the ground.

With regard to the material strength of optical fibers, the tensile strength of piano wires, which have conventionally been used in wire-guided missiles, is 300 kilograms per square millimeter, while that of quartz optical fibers is 500 kilograms per square millimeter. Therefore, it is sufficiently possible to adopt these optical fibers in wire-guided missiles which fly at high speeds.

The use of optical fibers in missile guidance systems will bring about larger advantages than the mere transmission of guidance signals. Pictures of targets projected on television cameras, IR (information retrieval) imagers, etc., incorporated in missiles are transmitted through optical fibers to the ground. In addition, these pictures are processed by using computers, and if circumstances require, targets will be tracked while considering the operator's judgments.

There is no need for an operator to expose himself to the enemy, because use of the above method will enable him to guide the missile while monitoring its target on the display. In addition, it is possible to guide a missile even if the enemy is out of sight.

It is considered possible to extend the distance from missile to target, depending on the improvement in material of optical fibers and development of transmitting-receiving systems.

Optical fibers are also used in sensors, and several kinds of sensors are being developed. Optical fiber sensors are manufactured by making use of the characteristic in which the intensity, phase, polarization, frequency, etc., of light which are propagated in optical fibers are changed according to the physical properties of the target.

Of the optical fiber sensors in particular, the optical fiber sound sensor, optical fiber magnetic field sensor, and optical fiber temperature sensor are regarded as sensors to be used in defense equipment. The optical fiber sound sensor employs nylon and polystyrene base elastomer having a high strain effect against sound, as composite materials (fiber materials). Optical fiber sound sensors are manufactured by making use of the characteristic in which these materials react to sound by expanding and contracting, and the light phase is changed on the optical fiber projecting end face. The U.S. Navy Research Institute is presently developing this type of sensor. It can have a very high sensitivity and is not easily affected by electromagnetic induction noise.

Optical fiber magnetic field sensors are manufactured by making use of the characteristic in which optical fibers expand and contract in a magnetic field. They employ nickel and metallic glass having a magnetostrictive effect, as composite materials of fibers. The sensitivity of these optical fiber magnetic field sensors is 100 times higher than that of optical magnetic resonance type magnetic detecting meters presently used in magnetic detectors.

Although optical fiber magnetic field sensors have almost the same sensitivity as that of SQUID (superconductive quantum interference device) sensors which employ Josephson devices, unlike SQUID sensors, there is no need to use a coolant in these optical fiber magnetic field sensors. In addition, they are not easily affected by electromagnetic induction. Therefore, it is greatly expected that they will be used as magnetic detectors in anti-submarine warfare, etc.

Optical fiber temperature sensors are manufactured by using thermal expansion materials instead of composite materials. They are similar to the previously mentioned sensors with respect to the use of the characteristic of expansion and contraction of optical fibers.

It is said that the minimum detecting sensitivity is on the order of one-10 millionth degree centigrade. This sensitivity exceedingly surpasses the sensitivity (0.1-0.01°C) of underwater temperature distribution measuring instruments presently being used in the Japanese MSD (Maritime Self-Defense Force).

Solid-State Image Sensing Device

The technology of solid-state image sensing devices has rapidly progressed since Boel, Smith, et al., invented the CCD in 1970. At present, the development of IRCCD's (infrared ray charge coupled devices), obtained by coupling infrared devices with signal processing devices for CCD's, is being carried out. This is attracting public attention as an important technology for missile sensors, etc., which must infrared-detect and track enemy targets.

IRCCD's are infrared detectors in which images are obtained by two-dimensionally arranging devices and electronically scanning these devices. The development of devices using silicon and indium ammonite has already reached the practical stage. Silicon and indium ammonite can obtain sensitivities at zones of 3 to 5 microns.

In addition, devices using mercury, cadmium, and tellurium, having sensitivities at zones of 8 to 14 microns, will soon appear in the world.

Although IRCCD devices must be cooled to a temperature of -170°C or less at all times, the structure of IRCCD equipment is simple, because IRCCD's have no mechanically movable sections. Therefore, it is anticipated that they will be greatly used as sensors for FCS (fire control system) in the future.

Conclusion

Up to now, I have described the present status and applicability of new materials with unique characteristics to the ordnance technology by use, respectively. Looking back at my descriptions, I think there are many sections short of explanation in the descriptions. If I find an opportunity, I will supplement these sections.

Specific aspects which have never been seen can now be seen in the high-technology which has rapidly attracted public attention in various fields in recent years, such as new materials. This is because the development of new technologies has always been carried out on the basis of research preceding military purposes. Subsequently, these technologies have been introduced into private enterprises.

For example, products such as computers, heat insulating materials, radio communication technology, agricultural chemicals, pharmaceuticals, etc., at the initial stage, as well as electric appliances such as air conditioners, refrigerators, etc., appeared in the world as by-products obtained from developing military technology. There are many enterprises which have grown by utilizing such by-products since World War II.

However, with regard to the field called "high-technology," the private level has completely preceded the military level in the 1980's. This may be a phenomenon peculiar to Japan.

Japan has completely renounced militarization since World War II. Japanese technology has reached top world levels during the 40 years since World War II. In addition, Japan stands third in the world as regards the research and development cost of science and technology. From the above-mentioned standpoints, we can understand how Japan has made every effort to become a high-level industrial country. But the research and development cost of military technology is very low, being almost equal to nil.

The research and development of ordnance technology have been carried out mainly by heavy industries up to now. However, the ordnance itself is now being changed from conventional forms to new forms. Ordnance technology has gradually been miniaturized by using microcomputers, etc., with high accuracy. It has seemed up to now there was no possibility of private technologies being used for military purposes, but these technologies have gradually been used for such purposes. It is so-called, "dual use"; i.e., use between private and military technologies.

An offer of ordnance technology to the United States, which has recently become an issue, can be cited as an example of dual use. The United States has requested Japan to cooperatively offer Japanese private technologies to the United States for the purpose of research and development of U.S. military technology. Japanese private technologies sought by the United States are related to millimetric waves, optical fibers, CAD (computer-aided design), ceramics, voice input and output, etc. All these technologies

have been purely developed by Japanese private enterprises. I wonder what this means.

It probably means that Japan is a potential big power with respect to military technology and will develop increasingly in the future while maintaining the high potential concerning military technology.

20143/6091
CSO: 4306/3543

DEFENSE INDUSTRY'S REQUESTS RELATED TO 59 CHUGYO

Tokyo KEIDANREN GEPPO in Japanese May 85 pp 54-56

[Article by Gakuji Moriya, chairman of the Defense Production Committee of the Federation of Economic Organizations and counselor of Mitsubishi Heavy Industries, Ltd.: "Aiming at Completing Foundation of Japanese Defense Industry; Summary of Requests for Mid-Term Defense Program Estimate for Fiscal 1984 and Proposal of These Requests to Relevant Bodies"]

[Text]

1

Following the Pacific War, it has been more than 30 years since the Japanese defense industry again started producing weapons, and the foundation of the industry has gradually been completed, but even now it has many problematical areas. The DPCFEO (Defense Production Committee of the Federation of Economic Organizations) has long been working in various fields of activity to foster the sound growth of the Japanese defense industry, which is one of the important elements of logistic support.

The Defense Agency is presently working out the mid-term defense program estimate for fiscal 1984, the so-called "59 Chugyo," which covers a 5-year period from fiscal 1986 to 1990 in the wake of "53 Chugyo" and "56 Chugyo" with the aim of reaching the defense capability level stipulated by the NDPO (National Defense Program Outline) decided at the Cabinet meeting held in October 1976.

At that time the DPCFEO had studied the required items while repeatedly exchanging views at board of directors meetings, etc. of the DPCFEO and contacting relevant industrial associations such as the Society of Japanese Aerospace Companies, Inc., the Shipbuilders' Association of Japan, the Japan Ordnance Association, etc., to reflect the intentions of the industrial world with the aim of working out this "59 Chugyo." As a result, on 12 April the DPCFEO summarized the "Requests for 59 Chugyo" mentioned later, and proposed them to the relevant bodies such as NDC (National Defense Council), LDP (Liberal Democratic Party), etc., as well as the prime minister and the Defense Agency director general.

The DPCFEO formally and officially announced this proposal in written form with consideration to the period which the Defense Agency is working out the 59 Chugyo. The main contents of the proposal cover matters which have been required officially and unofficially at every opportunity by the DPCFEO. Also, the proposal does not describe the high-level political problems such as contents of armaments covered by 59 Chugyo, the entire project scale of 59 Chugyo, the ratio of defense-related expenditures to the GNP (gross national product), etc., in the same way as the "Views on 56 Chugyo" summarized by the DPCFEO on 9 April 1982 so the Defense Agency can smoothly work out the 56 Chugyo.

The following is an outline of the contents of the proposal with consideration to the background, etc., of problems. The reader's understanding and cooperation for realizing this opinion would be appreciated.

(1) The Ideal Way of Chugyo

The main contents of Japan's defense buildup from the first defense buildup plan (fiscal 1958 to 1960) to the fourth defense buildup plan (fiscal 1972 to 1976) had been decided in advance by the NDC and the Cabinet and had been budgeted annually on the basis of the decided contents. But after fiscal 1977, the following method has been used. That is, the NDPO shows the basic framework concerning the defense buildup and operations, and the definite contents of armaments are decided each time a budget is required every fiscal year.

Although the Defense Agency has worked out the mid-term defense program estimates as reference data for preparing the service plan and budget requests in accordance with instructions, these mid-term defense program estimates have not been worked out as have those for obtaining armaments responsible to the entire government because they are worked out only by the Defense Agency.

On behalf of the defense industry, which plays an important part in logistic support, I urgently requested that the Defense Agency work out such estimates in cooperation with the government so they would inevitably become definite guidelines for the development and production of armaments.

(2) Promotion of Research and Development

In Japan there are many main armaments and pieces of equipment produced domestically on the basis of technologies introduced from foreign countries. Therefore, the promotion of research and development has become a more important subject than ever because it is currently difficult to introduce high-level military technologies from foreign countries.

We point out that the mid- and long-term concepts extending over both hardware and software should be clarified, and the research and development expenses, which are very much lower than those of foreign countries, should

be sharply increased in 59 Chugyo with consideration to the fact that up to now defects, particularly in software, have greatly interrupted the self-development of armaments and equipment. For example, of the defense-related expenditures for fiscal 1985, research and development expenses account for only 1.6 percent (more than 50 billion yen), which is much lower than the 11 percent (6.27 trillion yen) in the United States, 12.4 percent (770 billion yen) in England, 12.1 percent (550 billion yen) in France, and 4.1 percent (190 billion yen) in West Germany, as of 1984 in all cases.

(3) Promotion of Domestic Production

Needless to say, it is important to enhance the domestic production rate from the standpoint of the maintenance, repair, etc., of armaments and equipment, even when Japan cannot avoid introducing technologies from foreign countries. The higher the domestic production rate, the greater the number of armaments and equipment to be domestically produced. Therefore, this will result in completion of the defense industry foundation. Henceforth, it is desirable to take more proper measures.

We also insist that the FMS (foreign military sales) procurement method (burdensome aid between governments) should be reviewed, because problematical areas have been pointed out up to now, particularly in respect of delivery time and quality.

(4) Improvement of Matters Concerning Logistic Support

Conventional Chugyo's do not mention the estimate for obtaining matters concerning logistic support other than frontline armaments and equipment such as communication equipment, vehicles, ammunition, fuel, etc. We insist that 59 Chugyo should mention such estimates in light of the importance of the logistic support posture.

(5) Rationalization of Obligational Outlay Expenses for Subsequent Years

With regard to armaments accompanied by obligational outlay expenses for subsequent years, such as aircraft, ships, etc., it seems that measures for standardizing the obligational outlay expenses for subsequent years have been taken annually from the standpoint of financial reconstruction, and a backfall tendency has already reached the limit. We strongly requested that the government make improvements so the obligational outlay expenses for subsequent years are rationalized under conditions in which these expenses are fit for the production form of enterprises.

I have mentioned problematical areas of the Japanese defense industry up to now relating to the "Requests for 59 Chugyo." Finally, I want to say that there are many important problems such as the ideal methods of valuing the cost of armaments and equipment, etc., in addition to the above problematical areas.

[Boxed item p 56]

Requests for 59 Chugyo

12 April 1985: DPCFEO

The Defense Agency is presently working out the new mid-term defense program estimate for fiscal 1984, and this 59 Chugyo has great meaning for the defense industry in foreseeing the mid- and long-term developments and production of armaments and equipment. The Defense Agency should have a new appreciation of the fact that the defense production capacity is one of the important points of the defense buildup, consider the features of Japanese defense production and make every effort to complete and strengthen the foundation of Japanese defense production while stabilizing and standardizing the procurement of armaments and equipment and rationalizing their prices. Although we previously clarified the "Views of 56 Chugyo," we once more request the Defense Agency to work out 59 Chugyo with consideration to the following items.

1. Ideal Way of Chugyo

We have already mentioned the ideal way of Chugyo in the "Views of 56 Chugyo," and 59 Chugyo should be worked out so it becomes a definite guideline for developing and producing the armaments and equipment as an estimate for obtaining them responsible to the entire government.

2. Promotion of Research and Development

The research and development of armaments and equipment suitable for the national land and circumstances are indispensable premises for an effective defense buildup. Particularly in these days when it is difficult to introduce high-technology from foreign countries, the promotion of research and development is an exceedingly important subject. The Defense Agency should clarify the mid- and long-term concepts extending over both software and hardware and sharply increase the research and development expenses, which are very much lower than those in foreign countries, in 59 Chugyo with consideration to the fact that defects, particularly in conventional software, have encumbered the self-development of armaments and equipment.

3. Promotion of Domestic Production

There is no need to dwell on the necessity of promoting domestic production from the standpoint of maintenance, repair, etc., of armaments and equipment, even when Japan cannot avoid introducing technologies from foreign countries. Henceforth, it is desirable to take proper measures with the aim of raising the domestic production rate.

Also, it will be necessary to review the FMS procurement method because problematical areas have been pointed out up to now, particularly in respect of delivery time, quality, etc.

4. Improvement of Matters Concerning Logistic Support

The estimate for obtaining communication equipment, vehicles, ammunition, fuel, etc., which are not mentioned in conventional Chugyos, should be clarified in light of the importance of the logistic support posture.

5. Rationalization of Obligational Outlay Expenses for Subsequent Years

Special considerations are required for rationalizing the obligational outlay expenses for subsequent years under conditions in which these expenses are fit for the production form of enterprises with consideration to the fact that there is still a tendency for the rationalization of obligational outlay expenses for subsequent years to fall backward. [end boxed item]

20143/6091
CSO: 4306/2515

ANNUAL REPORT ON NUCLEAR POWER FOR 1984

Tokyo SHIGEN TO ENERUGI in Japanese Mar 85 pp 35-50

[Report by the Atomic Energy Commission: "Annual Report on Nuclear Power for 1984--An Outline"]

[Text] 1. Current Energy Conditions and Development of Electric Power Generation by Nuclear Power

(1) Development and use of Nuclear Power Under Current Conditions as the Energy Supply Deficiency

The petroleum supply deficiency across the world has been easing up recently, while the nation has seen its dependence on petroleum for its energy supply, drop from 78 percent at the time of the first oil shock to the current 62 percent, a fact which indicates a structural change in the nation's energy supply.

At a meeting of cabinet ministers held in November 1983 to establish an overall energy policy, a target of energy supply by fuels substituting petroleum was revised. A new target of energy supply by nuclear power was set at 74 million kiloliters in equivalent petroleum or a capacity for nuclear electricity generation of 48 million kilowatts for the fiscal year 1990, as compared with 67 million kiloliters in equivalent petroleum or a capacity of 48 million kilowatts for the fiscal year 1985, set at a previous cabinet-ministerial meeting in April 1982.

It is highly possible, however, that the supply of petroleum, which currently is not scarce, will become so in the future with the subsequent rise in the price of the material--this is now the commonly held view.

In addition, Japan's dependence on petroleum still remains higher than that of the other industrially advanced nations; due to the Iran-Iraqi War and the evident dynamics of the political conditions of the Middle East on which Japan depends for much of its imported petroleum, the structure of the nation's energy supply is very fragile.

Nuclear power generation has features distinctly different from those of power generation by fossil fuels in that the former is not only superior economically

and capable of supplying a large quantity of energy, but can also provide high stability in the supply of energy comparable to that of the energy of the fuel produced in the nation; providing an independent fuel cycle system is set up and plutonium effectively used. It is, therefore, necessary, to press for nuclear power generation so that the target of nuclear power generation contained in the supply target mentioned above is attained. It is also necessary to set up an independent nuclear-fuel-cycle system and to develop new types of power reactors so as to make the best of its ability to provide security in energy supply. It is also important to strive for further improvement of economic efficiency since reduction in the cost of energy is an important target of the nation's future energy policy.

Along with nuclear power generation, use of radioactive rays is an important element in the development and application of nuclear power; it is used in many industrial sectors such as medicine, the manufacturing industry, and agriculture, thereby contributing greatly to improvement of people's lives.

In view of the fact that the development and use of nuclear power will contribute greatly to security in the nation's energy supply and provide a basis on which to develop the economic community of the nation, the Atomic Energy Commission [of Japan] plans to press on with the development and use of nuclear power. Support and understanding must be rendered from the people at large, even though the energy supply shortfall, both at home and abroad, has been easing up recently as already stated.

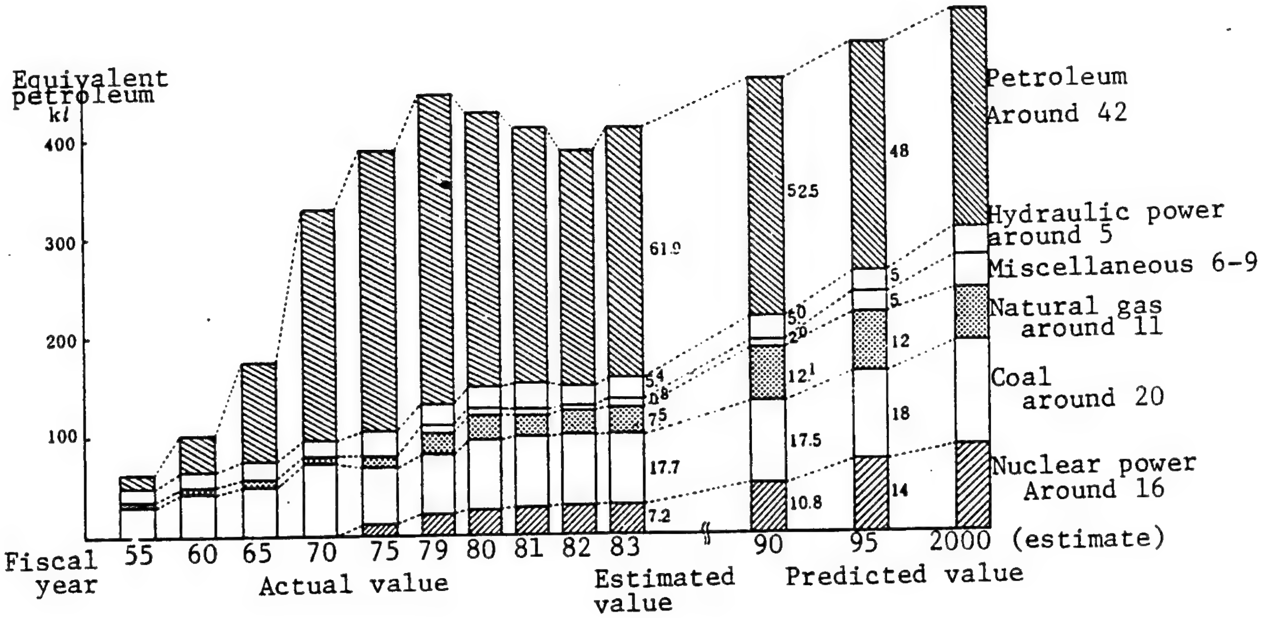
(2) Current Conditions and the Prospect of Nuclear Electric-Power Generation

a) Current condition of nuclear electric-power generation

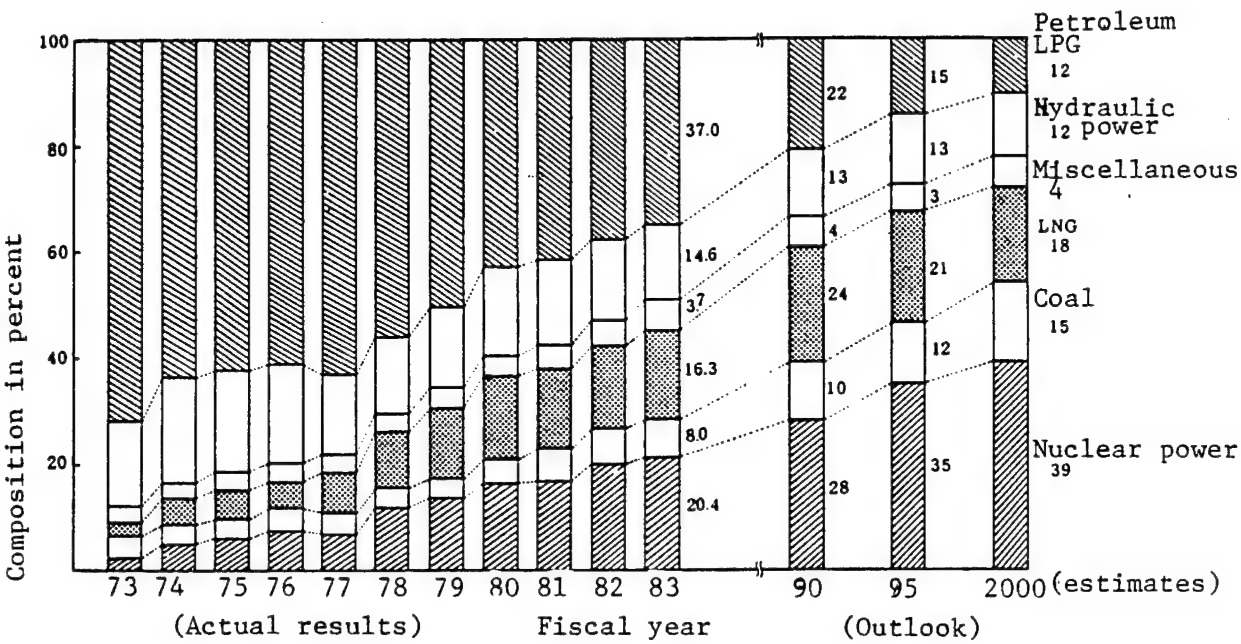
With its approach to a 20 million kilowatt capacity, the nuclear electric power generation of Japan is operating with extreme ease and has sufficient strength, technologically and economically, to play the central role in electric power supply.

In 1984, 3 units of the nuclear reactor began operation in succession, bringing the total of commercial nuclear power reactors now in operation to 27 units, with a total capacity of 19.69 million kilowatts, which accounted for 12.7 percent of the total capacity for electric power generation at the end of 1983.

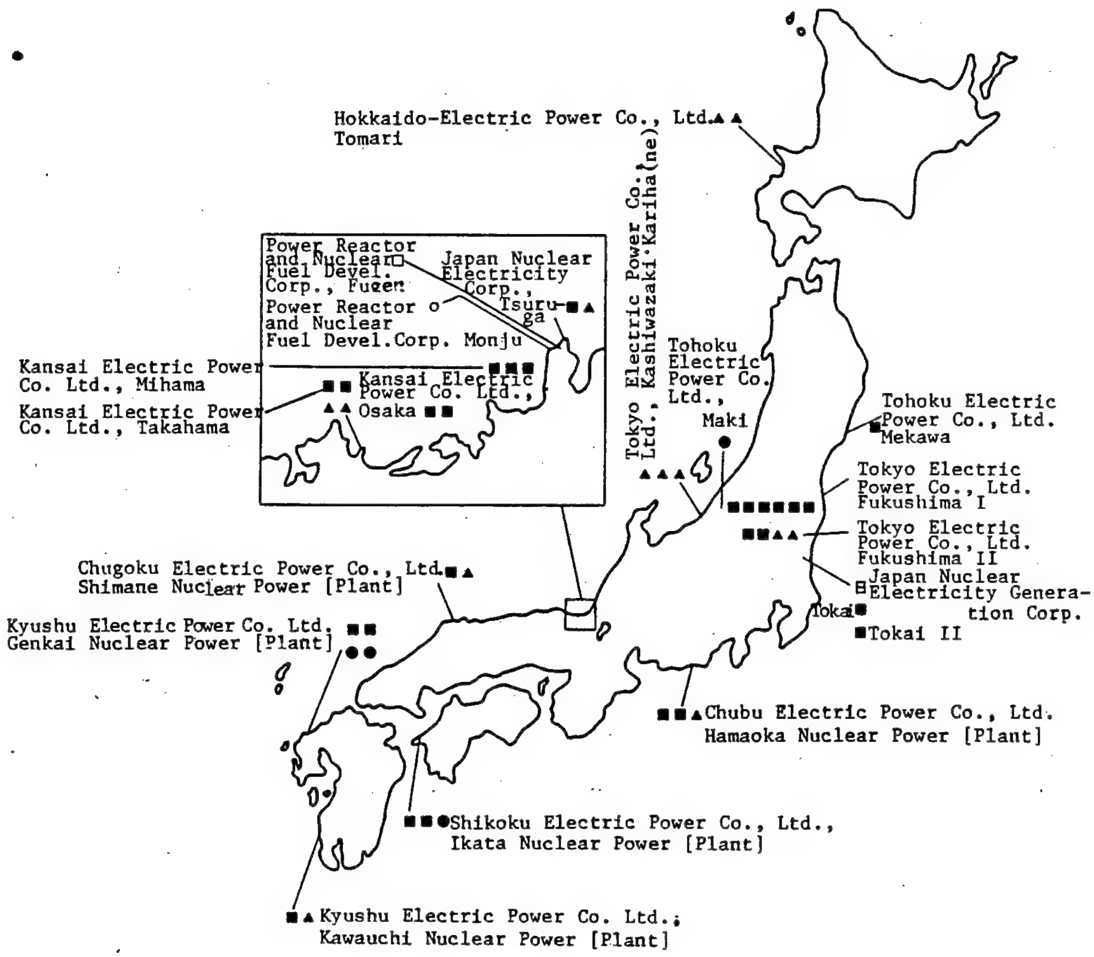
Fiscal year 1983 also saw nuclear power plants enjoy extremely steady operation. The use (or capacity) factor, which had passed the 60 percent level in fiscal year 1980, improved steadily from the point on and registered a rate of 71.5 percent in fiscal year 1983. This exceeded the 70 percent level for the first time since a nuclear electric power generation of large-scale capacity began functioning. This figure approaches close to that of full operation if we allow for the number of days required for routine checkups of the facilities. Consequently, the ratio of the quantity of electricity generated by the nuclear power plants to that by the total power plants exceeded the 20 percent level, to reach a ratio of 20.4 percent in connection with the electricity used for commercial purposes.



Annual Changes and Prospects of the Supply of Primary Energy of the Nation, Value in Percent of Share



Annual Changes of the Composition of Electricity Generated [as classified by fuels] and Relevant Future Outlook (for the Electric Power Industry)



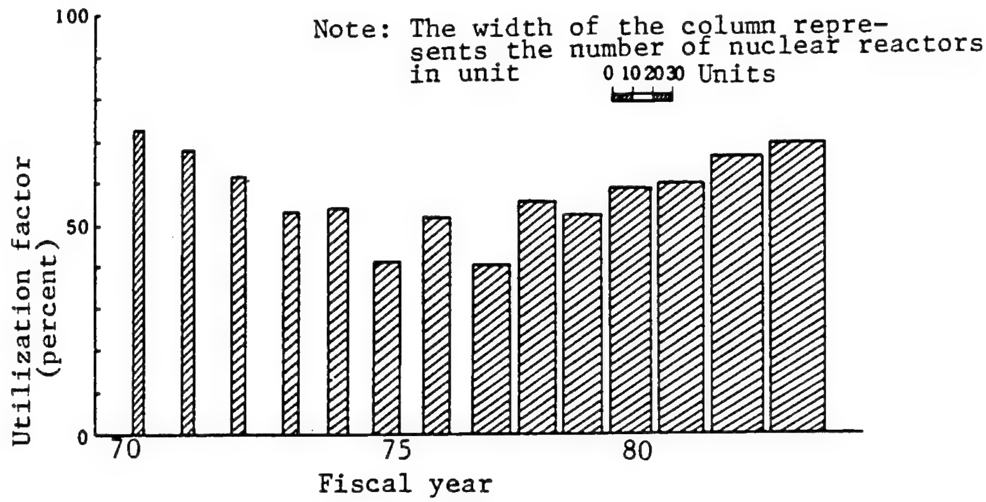
Commercial power reactor for electricity

■ In operation	27	reactor	units	19,691,000 kw
▲ Under construction	13	"	"	12,368,000 kw
● Preparation for the construction of plant	4	"	"	4,075,000 kw
Total	44	"	"	36,134,000 kw

Power reactor for electricity in the stage of research and development

□ In operation	1	reactor	unit	165,000 kw
○ Preparation for construction of plant	1	"	"	280,000 kw
Total	2	"	"	445,000 kw

Sites of the Nuclear Power Stations of the Nation, as of the end of August 1984



Annual Changes of the Utilization Factor for the Commercial Power Reactors

As for the nuclear electricity generation of the world, the number of nations having nuclear power generation facilities came to 25, with a total capacity of 290.5 million kilowatts, as of the end of June 1984. Of these nations, Japan ranks fourth in capacity, following the United States, France, and the Soviet Union.

b) Problems involved in pressing for nuclear electricity generation

i) Comprehensive security measures

To date, no cases have been reported of adverse effects on personnel of the nuclear power plants due to radioactivity from the facilities. There have been no cases of effects on people in the surrounding areas since a commercial nuclear reactor, the first in the nation, began operating in 1966. On the basis of this and other facts, the safety of nuclear power plants is understood to be an established fact.

It is important to continue efforts for safety maintenance as the major premise of the nuclear reactor operation.

ii) Improvement in credibility and economic efficiency

Since the scale of nuclear power generation is expanding, its weight in the nation's electricity supply increasing, and its effect on the economy of the people getting greater, it is important to further improve the credibility and economic efficiency of the light water reactor to eliminate a possible problem with the community.

Whereas the steam power generation is often dictated by the variation in fuel prices and fuel prices, in turn, are expected to rise soon as well as in

the future, nuclear power generation is seldom subjected to variation in fuel prices. It also has the prospect of further improving its economic efficiency by means of technological improvement, since it is highly technologically intensive.

Improvement of the economic performance of the nuclear power generation depends primarily on the acceleration of the use factor of the reactor and the reduction of the construction cost which has a high share in the cost of electricity generation. The reduction of the construction cost, in particular, must be continued by a concerted effort of the government and the people, allowing for maintenance of safety as first priority.

iii) Obtainment of reactor sites

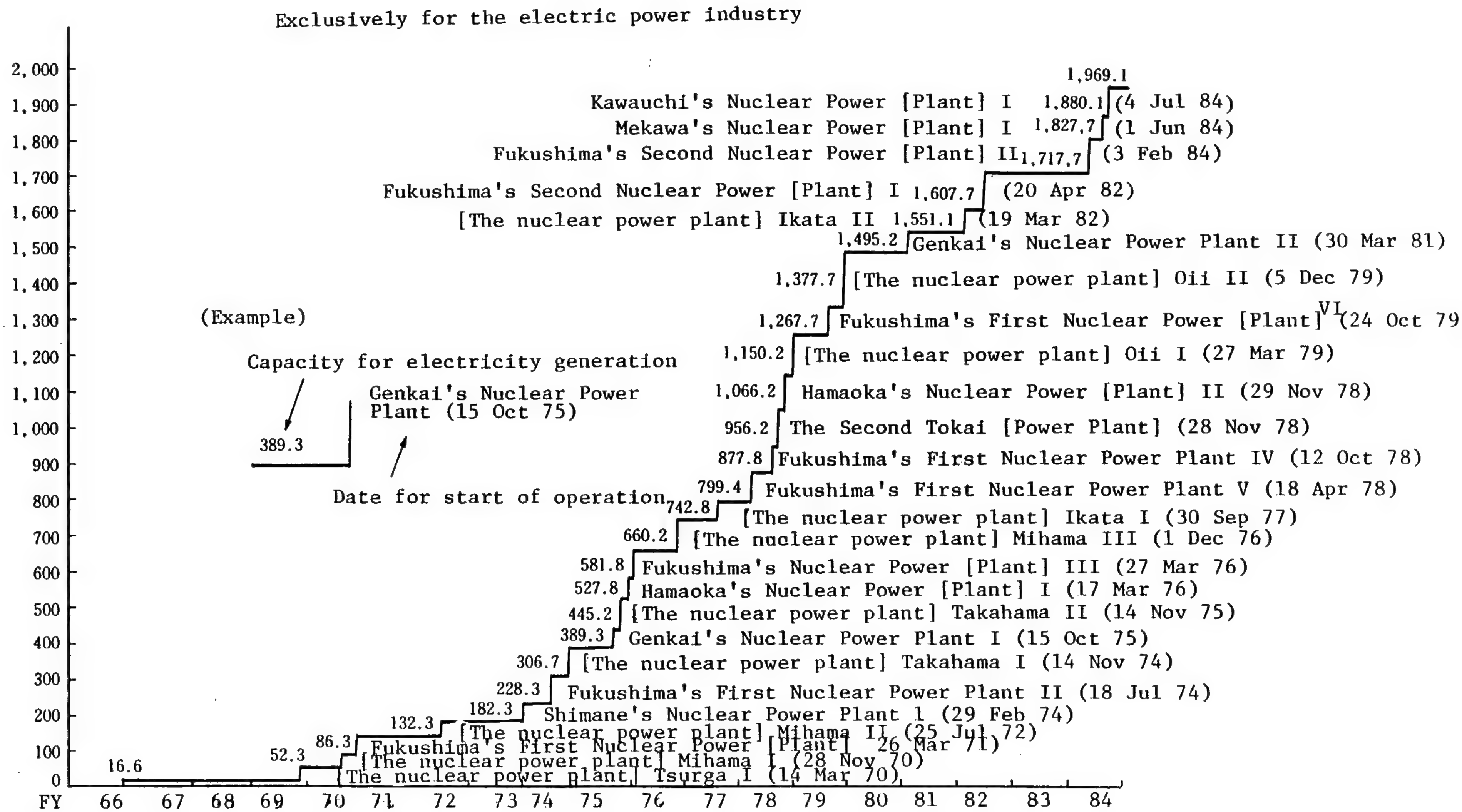
Proposal of nuclear power generation on the basis of a definite project requires continued efforts for obtaining reactor sites. It is of utmost importance to have the people, particularly those in the surrounding areas of the reactor site, understand the project and cooperate in it. A poll on nuclear power conducted in March 1984 by the Prime Minister's Office indicated that those who think of nuclear power generation as the primary means of power generation in the future, exceeded 50 percent for the first time and were on the increase. Nevertheless, it also showed that those who are worried about power plants increased from the previous poll made in November 1981. The reason for the latter's worry was often vague, indicating the requirement for further efforts to educate the people at large as to the safety of nuclear power generation as well as maintain the operational safety record of power plants into the future. It is also important to make the best of the three laws for eletricity resource development for the economic development of the areas surrounding the reactor sites.

iv) Improvement of the technology of the light water reactor

A project for the improvement and standardization of the light water reactor has been advanced in three successive stages to improve the technology of the reactor. Consequently, the second reactor of Fukushima's Second Nuclear Power Plant, a light water reactor of the boiling water type, began operation in 1984. The first reactor of the Kawauchi's Nuclear Power Plant, a light water reactor of the pressure type, also began operation in the same year. Both were the first plants to introduce comprehensive research results of the first project stage.

v) Decommissioning of the nuclear reactor

The decommissioning of a reactor, in principle, is carried out as soon as possible after the operation of the reactor has ceased. The technology development involved, including decontamination, dismantling, and removal has been carried out since 1981 by the Japan Atomic Energy Research Institute with the use of a power development reactor, JPDR, as the model. On the basis of the results thus achieved, an experiment to dismantle the actual reactor is expected to be carried out using the JPDR.



Annual Changes of the Capacity of the Nuclear Power Reactor for Electricity Generation of the Nation--as of the end of August 1984

2. Development Toward the Establishment of the Nuclear Fuel Cycle

(1) Establishment of an Independent Nuclear Fuel Cycle

The atomic power generation is different from the power generation using fossil fuel resources in that the plutonium and uranium recovered from the spent fuel by means of reprocessing are equivalent to a native energy resource. Their use permits more efficient use of uranium resource and less dependence on overseas nations for resources.

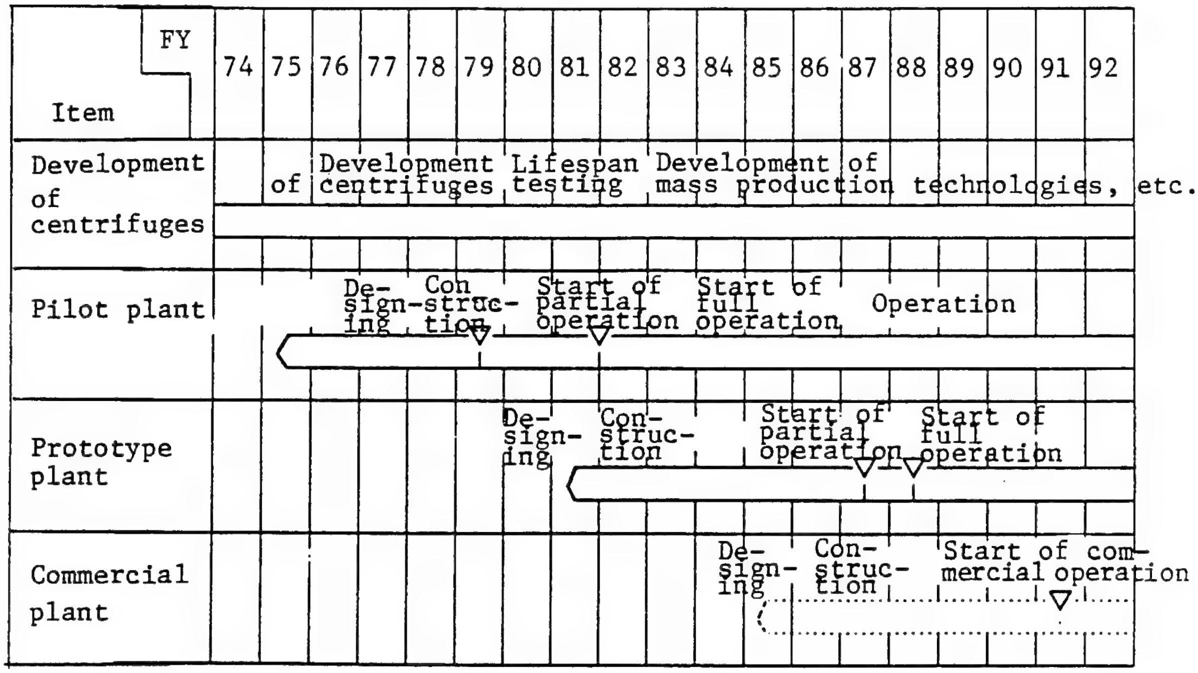
The use of uranium fuel by means of the light water reactor is not basically different from the use of fossil fuels as far as dependence on overseas nations for resources is concerned. Hence, it does not represent the best way of making use of nuclear power which, if efforts are made in technology for proper application of the plutonium, could reduce the nation's dependence on overseas nations for resources.

It is, therefore, of extreme importance that Japan, which is lacking in energy resources, establish an independent nuclear fuel cycle and provide for a system for the practical application of plutonium. The nation presently depends on overseas rations almost entirely for uranium enrichment and reprocessing of spent fuels. However, there is the possibility that the atomic power generation of Japan and progress in research and development may be hampered if atomic energy policies of nations supplying the enrichment service should change, or international situations surrounding the transport of nuclear fuels change adversely. Also in connection with the radioactive waste produced, the nation has yet to establish a system for the final disposal of the solid low-level radioactive waste from the power stations. The waste is currently safely stored in the compounds of the power stations.

The Power Reactor and Nuclear Fuel Development Corp. has to date taken the leading role in promoting the research and development of the nuclear fuel cycle. Among the private corporations, the Association of Electric Supply Enterprises, in April 1984, requested Aomori Prefecture for cooperation in developing a site on which to build a comprehensive set of facilities for uranium enrichment, reprocessing and storage of the low-level radioactive waste. In July of the same year, presented to the prefecture a plan of the project and the precise location involved; moves toward the practical establishment of the nuclear fuel cycle is gathering momentum.

It is highly significant in promoting the development and use of atomic power to see progress being made toward establishment of an independent nuclear fuel cycle by the effort of those concerned as described above. It is important that the government and the industry, in unison, strive for early establishment of an independent nuclear fuel cycle.

The Atomic Energy Commission at this juncture, is holding, as required, conferences for the advancement of the nuclear fuel cycle in an attempt to push through effectively all measures associated with the nuclear fuel cycle. It also set up a forum to press ahead with reprocessing. At the forum, surveys and discussions are being made on how to push reprocessing of spent fuel



Schedule for the Development of the Technology of Uranium Enrichment by Means of the Centrifuge Separation Method

in the future, based on the long-term prospect of the nuclear power development of the nation. The processing and disposal of the radioactive waste meanwhile, is being surveyed for its implementation by the Special Committee for the Disposal of Radioactive Wastes which, in August 1984, presented an interim report to the Atomic Energy Commission.

(2) Present Status of Nuclear Fuel Cycle

a) Uranium enrichment

The domestic production of enriched uranium should be supported by any means in order to maintain the independence of the nation in every step of the nuclear fuel cycle following uranium enrichment, including the use of plutonium, as well as to obtain the steady supply of enriched uranium. Japan has been pressing ahead with the development of the technology of uranium enrichment based on the centrifuge separation method with the Power Reactor and Nuclear Fuel Development Corporation playing the central role. The corporation has been operating a pilot plant at Ningyo Pass in Okayama Prefecture. With regard to the prototype plant experiment, which is slated to follow the one at the pilot plant, the site of construction was decided in November 1983 to also be at Ningyo Pass. The safety assessment involved is presently underway. Private corporations, meanwhile, are preparing for the construction of a commercial plant, with the start of the operation expected to begin in around 1999.

Industrial nations of the West, on the other hand, are pushing technology development aimed at reducing the cost of the enrichment service. The nation also has to engage itself in the future in technology development for higher reliability and economic efficiency if the uranium enrichment enterprises of the nation are to be competitive in the world market.

b) Reprocessing of the spent fuel

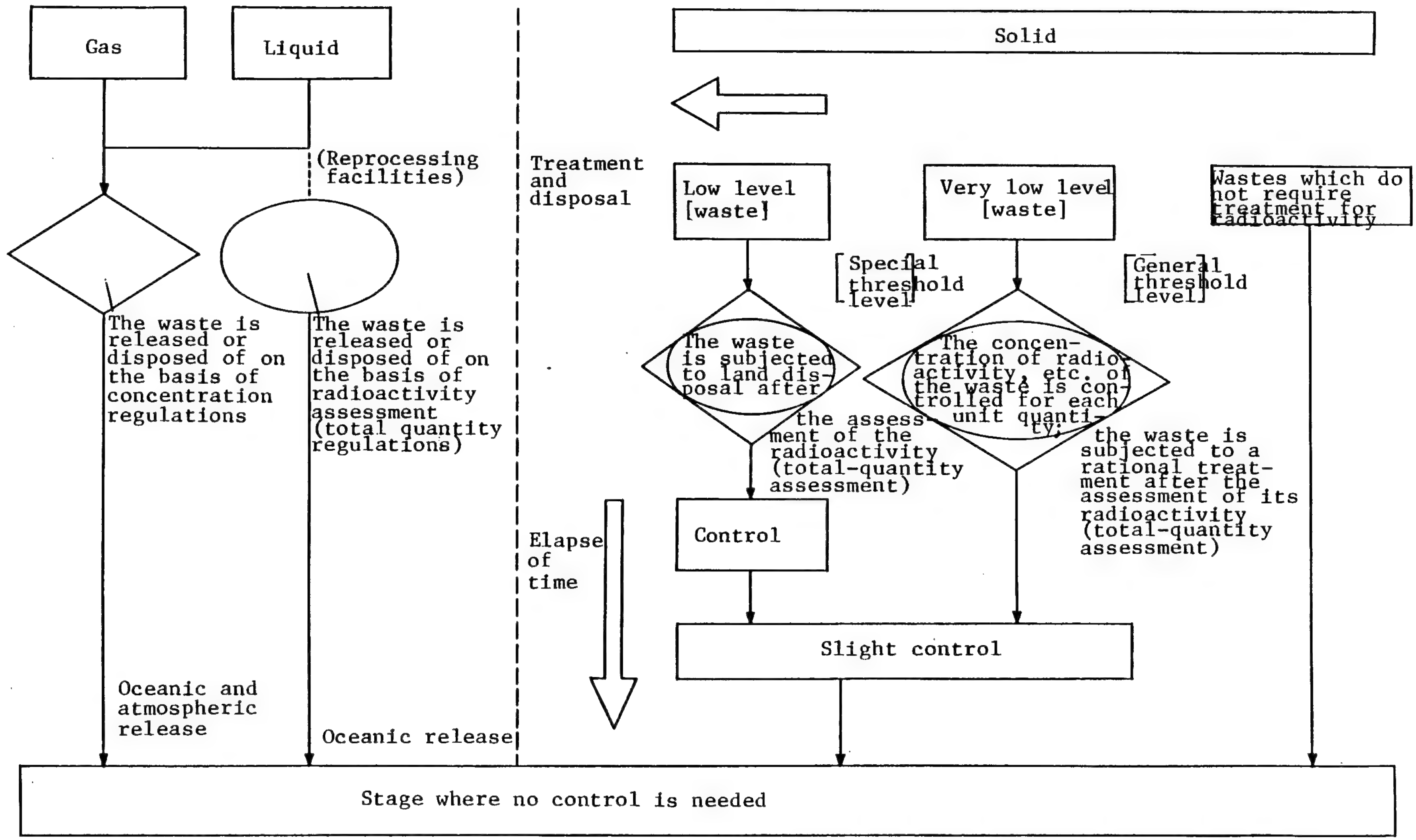
Establishment of a reprocessing technology or of a system in which carrying out reprocessing on its own implies that the nation, which has scarce domestic energy resources, create a new domestic energy resource by virtue of a technology. Though Japan currently commissions reprocessing of most of the spent fuel to Britain and France, it plans to have its own reprocessing plants fulfill the domestic requirements for reprocessing in the future. This is based on the principle that the nation's spent fuel be reprocessed by reprocessing plants of its own in order to establish an independent nuclear fuel cycle in the nation. Reprocessing by domestic plants is also of significance because transport of recovered plutonium from abroad involves much uncertainty.

The Power Reactor and Nuclear Fuel Development Corporation plays the central role in promoting technology development of the reprocessing of the nation's fuel. The Tokai plant of the corporation, though currently not in operation, is expected to resume work early in 1985.

Where private organizations are concerned, Japan Nuclear Fuel Service Co. Ltd., a private organization, is preparing for the construction of a commercial plant with the starting date of the operation set at around 1995. It is important for the design and construction of a reprocessing plant that the experience and technological achievements attained by the construction and operation of the Tokai reprocessing plant be fully made use of.

c) Processing and disposal of radioactive waste

The processing and disposal of radioactive waste is a matter for grave concern to the people at large and establishment of the method involved is an urgent problem. In principle, the low level radioactive waste is subjected to both oceanic and land disposal and the very low level radioactive waste must have a disposal method which will be established logically in accordance with the radioactivity level. In an interim report released by the Special Committee for the Disposal of Radioactive Waste, the committee classifies what has so far been called low level radioactive waste into three types--the low level waste, the very low level waste, and the waste that does not require special treatments. The former two types of waste are subjected to special disposal measures which have to be worked out logically in accordance with their radioactivity levels. It has been regarded as a realistic measure to have the low level radioactive waste stored in a facility which permits long-term control of the waste outside of the compounds of the atomic power stations, and efforts for its materialization have led to the preparation by private corporations for the construction of facilities for storing the waste. These are scheduled to begin operation in about 1991.



*The rational treatment above comprises simple treatment and recycling

Flow Chart for the Disposal of [Radioactive] Waste

The high level radioactive waste, in principle, is subjected to solidification into a stable shape and then into storage to allow it to cool, until it is suitable for a disposal operation in a geological or rock layer. The research and development on the solidification and disposal has been underway primarily due to the efforts of the Power Reactor and Nuclear Fuel Development Corporation.

(3) Stepped-up Efforts for the Obtainment of Sites for Nuclear Fuel Cycle Facilities

The moves for procuring sites for nuclear fuel cycle facilities have recently become notable; one, for example, is the site of a prototype plant for uranium enrichment decided in November 1983. Another is the request made to Aomori Prefecture by the electric supply industry for cooperation in finding a site for nuclear fuel cycle facilities in April 1984. These moves must be evaluated highly as representing the efforts of the corporations concerned in locating sites. The government, for that matter, is going to lend itself to these projects on the basis of understanding and cooperation of the local population. The siting of the facilities, compared with the ones for atomic power stations, has few precedents and hence must face greater difficulties than those of the latter. It is, therefore, necessary to provide for smooth agreements between corporations and locals on sitings.

3. Progress in the Major Research and Development Involved

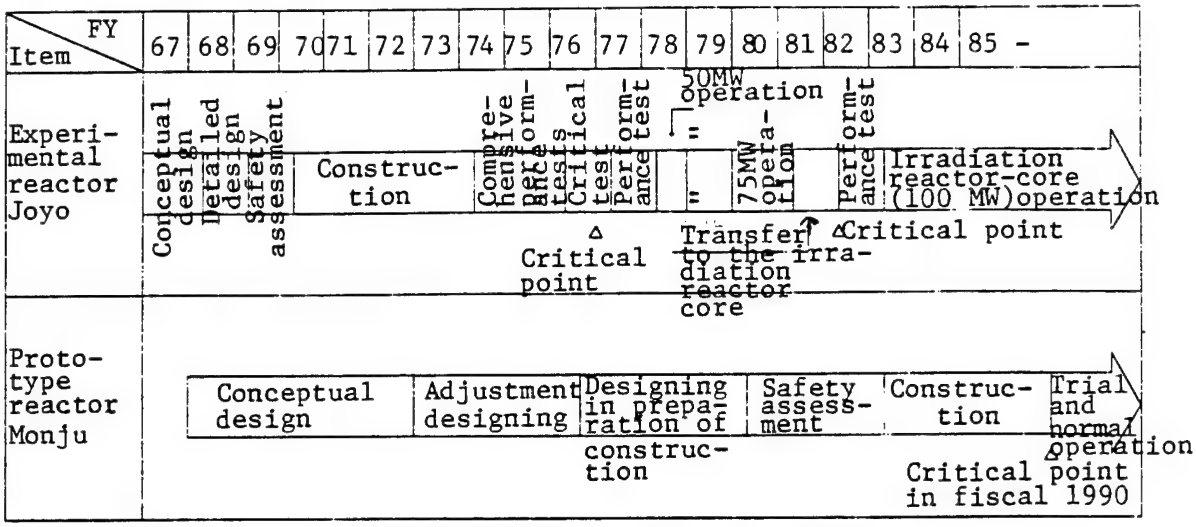
(1) Fast Breeder Reactor

The fast breeder reactor is expected to play the dominant role in the future atomic power generation and has been developed primarily by the Power Reactor and Nuclear Fuel Corporation. Experience and technology have been built up in the course of construction and operation of the experimental reactor "Joyo" and, on the basis of this buildup, preparatory work for the construction of the prototype reactor "Monju" is now underway. The reactor is scheduled to reach the critical point in 1990.

The development of the demonstration reactor is being discussed and surveyed by the Forum for the Development of the Fast Breeder Reactor. The major factor in the construction of the demonstration reactor is the close cooperation between the Power Reactor and Nuclear Fuel Development Corporation and the electric supply industry. Consultations between the two have been carried out, as required, since December 1983.

(2) Advanced Thermal (converter) Reactor and Plutonium Use

The advanced thermal (converter) reactor has been developed by Japan on its own and plans to use plutonium at the earliest possible time. The Power Reactor and Nuclear Fuel Corporation is playing the dominant role. The prototype reactor "Fugen" is operating smoothly while gaining in greater experience and technologies. The construction and operation of its demonstration reactor are scheduled to be carried out mainly by the Electric Resources Development Co. Ltd. An environmental survey has been conducted at the scheduled site of



Process of Development of the Fast Breeder Reactor in the Past and Future Prospects

construction in Omamachi, Aomori Prefecture, since August 1983. The designing and construction will be carried on, with the time of the operation set in the early 1990's.

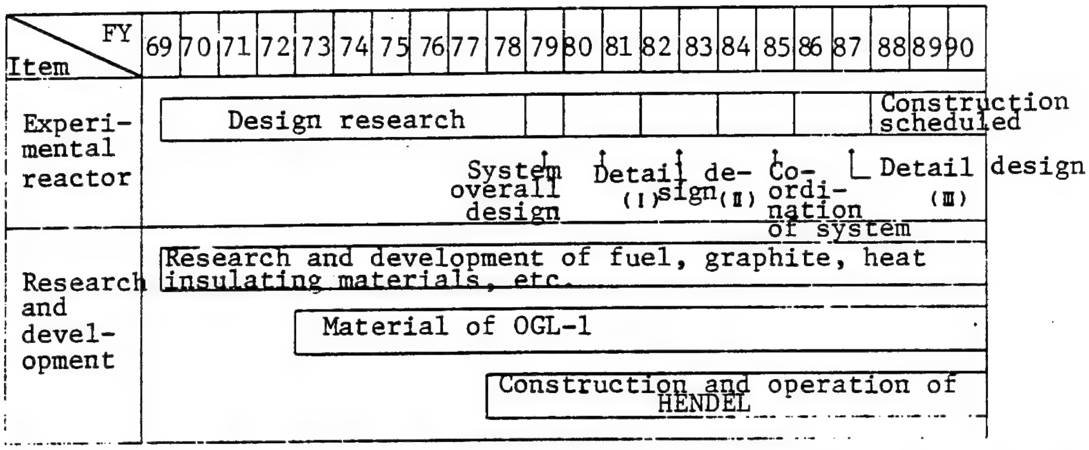
Meanwhile, the electric supply industry is continuing, for the most part, with the development of technology for the use of plutonium with the light water reactor, which represents a means of early use of the material. An irradiation experiment is about to begin on a reduced scale of [fuel] assembly.

In connection with the use of plutonium, the Power Reactor and Nuclear Fuel Development Corporation is proceeding with research and development on the fabrication of plutonium uranium mixed oxide fuel and reprocessing of the spent fuel of the fast breeder reactor. The smooth progress of this research and development is exemplified by the recovery of plutonium in September 1984 at the High Level Radioactive Material Research Institute; from the irradiated fuel of the reactor "Joyo," the recovered plutonium was recharged. This completed the first nuclear fuel cycle in the fast breeder reactor, though on an experimental reactor scale.

(3) Multipurpose High Temperature Gas Cooled Reactor

Use of nuclear power as an energy source in this nation is limited to the sector of electricity. However, if stable supplies of energy are to be maintained, it is important also to make use of the relevant power in the nonelectricity sector, which accounts for some 70 percent of the total energy consumption.

Presently the Japan Atomic Energy Research Institute is pushing ahead with research and development on issues related to the experimental reactor, as well as with the detailed designing of the experimental reactor and with a helium engineering demonstration loop, Hendel.



Outline for the Process of Development of the Multipurpose High Temperature Gas Cooled [Reactor] in the Past and Future Schedule

(4) Use of Radioactive Beams

The use of radioactive beams in a wide range, including industry, agriculture, and medicine, is contributing in large measure to the improvement of people's lives, and constitutes a major element in the application of nuclear power for peaceful purposes, in nuclear power generation.

Research and development is being pushed ahead by the Japan Atomic Energy Research Institute, by research and experiment organs of the Ministry of Agriculture, Fishery, and Forestry, etc., and by the General Research Institute of Radiation Medicine to aid the industrial, agricultural, and medical sectors, as well as fishery, and forestry. Many notable results have been attained.

Where application in medicine is concerned, X-ray diagnosis, and particularly X-ray computer tomography are finding wide applications in diagnosis. As for treatment, X-ray, electron beam, and γ ray are widely used against cancer. Treatment by means of fast neutron beam, proton beam and baryon beam are also under development.

(5) Nuclear Powered Ships

Research and development of nuclear powered ships is being pushed ahead predominantly in connection with the ship "Mutsu." On the basis of an agreement with the local population, the ship Mutsu is being moored in Port Omimato until a new mooring port in Sekinehama, on which construction began in February 1984, has been completed, to where the ship is to be transferred. The Atomic Energy Commission, meanwhile, has decided on the necessity of, and manner for, research and development of nuclear powered ships, on the basis of a report from the Forum for the Nuclear Powered Ships, in January 1984. In a draft budget for fiscal 1985 to be submitted to the Finance Ministry, the commission estimated, on the basis of the above decision, the cost for the construction of the new mooring port, etc. required for an experimental

Present Status of Research and Development on the Treatment of Cancer by Means of Fast Neutron and Positron Beams

Radiation	Fast neutron	Positron
Feature	High biological effects	Sharp black peak, superior spectral distribution, transmission diagnosis possible
Research organ	General Research Institute of Radiation Medicine Research Institute of Medical Science affiliated with Tokyo University	General Research Institute of Radiation Medicine, Center of Medical Science for Particle Beams affiliated with Tsukuba University
Start	1975, 1976	1976, 1983
Number of cases treated	1,188 cases 407 cases	26 cases --
Reference	Most effective in the treatment of X-ray resistant cancer and local progressive cancer	Radiation injury to normal tissues is minimal

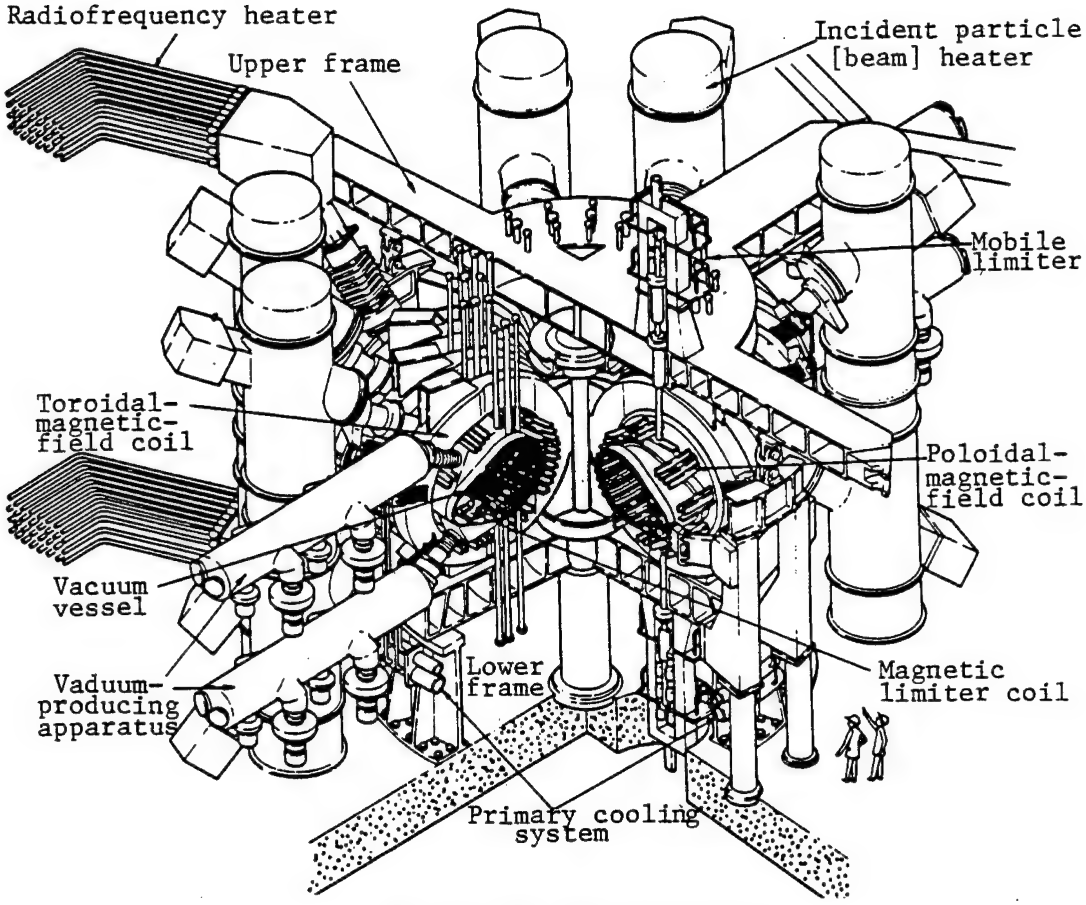
(As of March 1984)

voyage of the ship, which must be carried out with dispatch in order to obtain knowledge and data indispensable for the research and development of the ship's nuclear reactor, allowing for the curtailment of costs as well as the security involved, which is the major prerequisite. The commission did this in spite of the controversies raised in Parliament and by others concerned, following the decision on the future of the ship Mutsu.

(6) Nuclear Fusion

Energy derived from nuclear fusion, if harnessed in a practical manner, will make an extremely rich energy source. Much hope, therefore, is placed in it as the source of energy that guarantees the future of man.

The nation's research in nuclear fusion has reached a level comparable to that of other industrially advanced nations, and is being helped along by the Japan Atomic Energy Research Institute, universities, and research and experiment organs of the government, etc. The Japan Atomic Energy Research Institute is presently charging ahead with the construction of a critical facility for plasma of the Tokamak type, or JT60, with the start of the heating experiment scheduled for 1986. Research on the containment of plasma of various types is also being advanced.



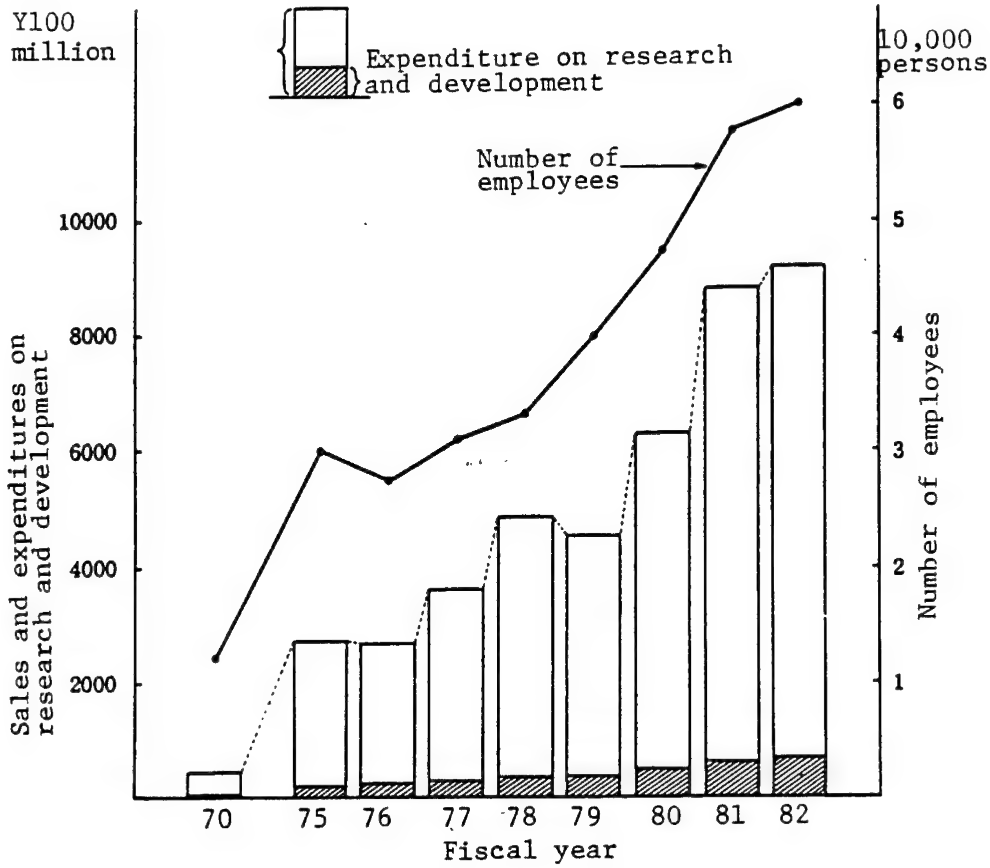
Bird's-eye View of JT-60

4. International Cooperation and Nuclear Nonproliferation

(1) International Cooperation

The tide for international cooperation has been on the rise recently in the sector of atomic energy. Among the industrially advanced nations, bilateral and multilateral cooperation is being carried out on diverse subjects including safety issues involved, the fast breeder reactor, and nuclear fusion. Developing nations meanwhile, and particularly those Asian nations surrounding Japan, have been placing increasingly high hope on the nation in recent years. Japan is going to lend itself positively to these developing nations for the purpose of consolidating its relations with them and fulfilling its international obligation as a nation with advanced nuclear technology.

It is necessary, in pressing for international cooperation, to deal with various problems posed, based on the Atomic Energy Commission's decision that the Atomic Energy Act be obeyed in the event the nation lends itself to the use of nuclear energy in other nations.

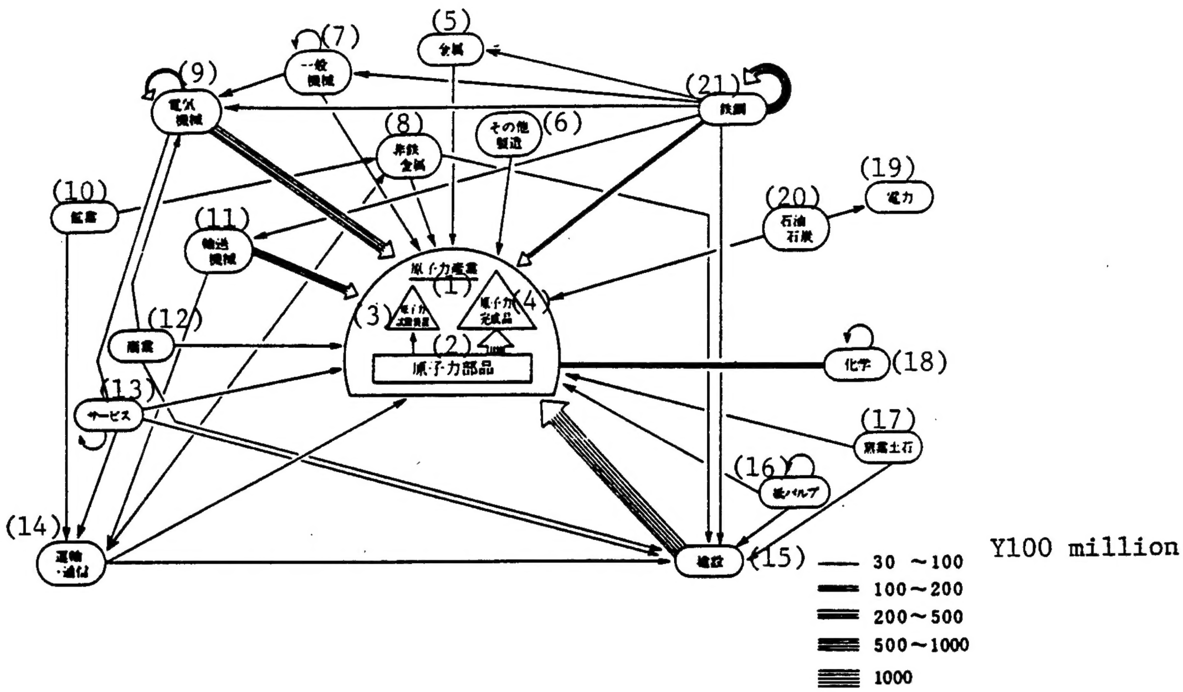


Annual Changes of Sales (equivalent to end use), Expenditure on Research and Development, and the Number of Employees in the Nuclear Power Industry of the Nation

Source: Survey report on the actual state of the nuclear power industry.

To enhance cooperation with the developing nations, the Atomic Energy Commission set up a Forum on the Problem of Cooperation with the Developing Nations and had the forum survey and discuss the methods for advancing and facilitating cooperation. The forum, in turn, submitted a report to the commission in September 1984.

China plans to proceed with the construction of atomic power stations with help from other nations and was admitted to the IAEA in October 1981. Cooperation between Japan and China had been conducted on a private basis. However, an agreement was reached at a third ministerial level meeting of the two countries in September 1983, on continuing discussions for the enhancement and expansion of cooperation between the two nations in the peaceful use of atomic energy. As a result, consultations on atomic energy have been conducted since October 1983 primarily in negotations for a Japan-China atomic energy treaty. There is progress in such things as exports of pressure vessels of the reactor to the Taizan atomic energy station, and a joint survey of uranium resources in China, etc.



Relation of Transactions Among Industries Resulting From the Production of the Nuclear Power Industry in 1980

(for transactions involving transaction values of over Y3 billion)

Note:1)Nuclear-power components; 2)Represents the manufacturing sector of nuclear machine parts; nuclear experimental reactors; 3)Does the manufacturing sector of reactors for research purposes, etc.; and completed units of the nuclear power reactor; 4)The manufacturing sector of commercial nuclear power reactors.

Key:

1. Nuclear power industry
2. Nuclear power components
3. Experimental nuclear reactors
4. Completed units of the nuclear power reactor
5. Metal [industry]
6. Other manufacturing [industry]
7. General machinery [industry]
8. Nonferrous metal [industry]
9. Electric machinery [industry]
10. Mining [industry]
11. Transportation machinery
12. Trading
13. Service
14. Transportation and communication
15. Construction
16. Paper and pulp
17. Ceramics, soil, and stones
18. Chemistry
19. Electric power supply
20. Petroleum and coal
21. Steel

(2) Nonproliferation

The nation has engaged in the development and use of atomic energy exclusively for peaceful purposes on the basis of the Atomic Energy Act. Internationally, it also made evident its stand on limiting the use and development of atomic energy strictly to peaceful purposes, by ratifying the "Treaty for the Non-proliferation of Nuclear Weapons," or NPT, and accepting the safeguards of the IAEA.

Japan presently depends on overseas nations for most of its uranium ores, enrichment of the mineral and reprocessing. It is important for Japan to gain the world's understanding regarding its policy for atomic energy development, which is limited exclusively to peaceful purposes if the development and use of the energy in the nation are to go ahead smoothly. It is also necessary to allow sufficiently for nuclear nonproliferation as a receiver and supplier nation with nuclear reactor materials and technologies. International actions include continuing consultations between the United States and Japan on the reprocessing problems and a review of the international system (IPS, CAS, ISFM) being carried out primarily at meetings of IAEA.

5. The Emergence of an Independent Nuclear Energy Industry

(1) Present State and Future Problems of Japan's Nuclear Industry

Development of the nuclear energy industry is essential if the development and use of nuclear power is to progress steadily.

Japan's nuclear energy industry posted a sale of Y1.17 trillion or an end use of Y0.91 trillion, with its account balance in the black. The growth rate of the industry is around twice that of the manufacturing industry. Research and development of the former is carried out with more vigor than for the latter. Nevertheless, the specialization number in connection with research and development is falling. Phenomena such as expansion of industrial scale, stabilization of management, the fall in the share of research and development costs, etc. must indicate that the industry is maturing and becoming independent in stages.

For the nuclear energy industry to develop soundly in the future, in addition to the smooth progress and development of nuclear electricity generation, it is necessary to push exports of products related to nuclear energy and, over the long period, encourage research and development of a wide range of applications of nuclear energy in fields other than electricity generation. Exports of nuclear energy related products have so far comprised component and material and machines and instruments using radioactive beams. However, inquiries are being made into the machines and equipments of nuclear reactors, reflecting the nation's high level of technology. Japan needs to step up its technological basis, nuclear fuel service, financial aid and other conditions in connection with the export of a nuclear power station, which is expected to be completed in the next few years. It is also essential to give sufficient consideration to nuclear nonproliferation in exporting the above items.

Table for Reference Budgets Related to Nuclear Power Application for 1984

Ministries and agencies Item	Science and Technology Agency	International Trade and Industry Ministry	Foreign Affairs Ministry, etc.	Total
General account	debt 46,101 166,112 (debt 65,664 173,127) (95.9%)	305 (328) (93.0%)	3,228 (2,970) (108.7%)	debt 46,101 169,645 (debt 65,664 176,425) (96.2%)
Special account for the enhancement of development of electric resources	debt 76,535 78,745 (debt 16,113 70,742) (111.3%)	58.186 (44,755) (130.0%)		debt 76,535 136,931 (debt 16,113 115,497) (118.6%)
Account for obtaining sites in connection with electric sources	10,481 (9,488) (110.5%)	40,049 (31,320) (127.9%)		50,530 (40,808) (123.8%)
Account for the diversification of electric sources	debt 76,535 68,264 (debt 16,113 61,254) (111.4%)	18,137 13,435 (135.0%)		debt 76,535 86,401 (debt 16,113 74,689) (115.7%)
Total	debt 22,635 244,857 (debt 81,776 243,869) (100.4%)	58,491 (45,083) (129.7%)	3,228 (2,970) (108.7%)	debt 122,635 306,577 (debt 81,776 291,921) (105.0%)

Unit: million yen

(Debt): limit of a debt borne by the National Treasury

Note: Budgets for the year 1983 are indicated in parentheses; ratios to the previous year, the year 1983, are also presented in percent in parentheses; addition of individual items does not agree with the total given in some cases because the figures are rounded.

(2) Expanding Economic and Technological Effects of Nuclear Energy

Nuclear energy is presently finding a wide range of applications in the sectors of energy and radiation beams, and the development of the nuclear energy industry is expected to exert a far-reaching effect technologically.

Results of analysis, based on the inter-industry relation table for the year 1980, in connection with the nuclear energy industry, are presented in the figure. It will be noted that both the production-inducing effect and employment-inducing effect for the nuclear energy industry are above the averages of those for all industries. The extended effect of the industry is high, relative to all the other industries.

It is hoped that nuclear power technology, which is highly advanced, will play a major role in stepping up the level of Japan's science and technology, upon which, as it progresses, it will base its prosperity. The nuclear energy technology, in which a wide range of technologies of diverse fields is integrated, and which has far-reaching effects on various fields of technology, represents a giant system of engineering required for an extremely high degree of reliability. It is contributing greatly to the improvement of control technologies of entire systems such as assessment of systems, quality control and quality guarantee and engineering technologies.

As discussed above, the development and use of nuclear power contributes greatly to the development of the nation, economically and technologically, not just to the stable supply of energy and the application of radiation beams. In view of this, it is very important to press forward with the development and use of nuclear energy.

20,128/9365
CSO: 4306/2516

END